

REMARKS

Applicants note the filing of an Information Disclosure Statement herein on January 29, 2002 and note that no copy of the PTO-1449 was returned with the outstanding Office Action. Applicants respectfully request that the information cited on the PTO-1449 be made of record herein.

The Office Action mailed April 3, 2002, has been received and reviewed. Claims 16-29 are currently pending in the application. Claims 16-29 stand rejected. Applicants have amended claim 29 and added new claim 30, and respectfully request reconsideration of the application as amended herein.

35 U.S.C. § 112 Claim Rejections

Claims 16-29 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for allegedly failing to particularly point out and distinctly claim the subject matter that applicants regard as the invention. Applicants respectfully traverse this rejection, as hereinafter set forth.

Claims 16, 28, and 29 are rejected as being indefinite for the limitation of “dissolving the organic composition and either a C₁-C₄ short chain alcohol or water into the critical fluid medium.” Dependent claims 17-27 are also rejected as depending from claim 16. The Office asserts that the limitation in claims 16-29 is indefinite “because the previous steps do not provide for the alcohol or water.” Office Action of April 3, 2002, page 2. Applicants respectfully submit that the rejection is improper because there is no requirement that a C₁-C₄ short chain alcohol or water be recited in a “providing” step. Furthermore, the claims, as written, establish proper antecedent basis for a C₁-C₄ short chain alcohol or water. This limitation provides the first mention of a C₁-C₄ short chain alcohol or water and, therefore, the claims properly recite “dissolving . . . either a C₁-C₄ short chain alcohol or water into the critical fluid medium.” (emphasis added). Therefore, applicants respectfully request that the rejection of independent claims 16, 28, and 29 and dependent claims 17-27 be withdrawn.

Claim 29 is rejected as being indefinite for the limitation of "wherein the critical fluid is one selected to have a critical temperature within about 20% of the reaction temperature and a critical pressure as modified by any co-solvent within a range of about 0.5 to about 15 times the reaction pressure." The Examiner asserts that this limitation is indefinite because "the previous part of the claims does not provide for any 'co-solvent.'" Office Action of April 3, 2002, page 2. Claim 29 has been amended to recite "a co-solvent." However, there is no requirement that the co-solvent be recited in a "providing" step. Since this limitation provides the first mention of a co-solvent, claim 29, as amended, establishes proper antecedent basis for a co-solvent.

The Examiner also asserts that this limitation "does not coincide with the limitation provided in the last paragraph on page 7." Office Action of April 3, 2002, page 2. The cited portion of the specification does not disclose anything related to the subject of the co-solvent or the critical fluid medium. However, Applicants submit that adequate support for this limitation is provided in the specification. See page 2, lines 24-28 and page ⁶¹5, lines ²⁴⁻²⁶30-34. Based upon these reasons, applicants respectfully request that the rejection of independent claim 29 be withdrawn.

35 U.S.C. § 103(a) Obviousness Rejections

Claims 16-29 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,520,708 issued to Johnson et al. ("Johnson"), combined with U.S. Patent No. 4,695,411 issued to Stern et al. ("Stern") or U.S. Patent No. 5,578,090 issued to Bradin ("Bradin") in view of Japanese Patent Nos. JP 09 157 684 A and JP 63 112 536 A (collectively referred to as the "Japanese abstracts").

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or

references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The Office bears the burden of establishing a *prima facie* case of obviousness by establishing all three of these requirements. To provide a suggestion or motivation to combine, the cited references must suggest the desirability of combining the references or provide an objective reason to combine the teachings of the references. M.P.E.P. § 2143.01.

Applicants respectfully submit that the 35 U.S.C. § 103(a) obviousness rejections of claims 16-29 are improper because a *prima facie* case of obviousness has not been established. Specifically, Johnson, Stern, Bradin, and the Japanese abstracts do not teach or suggest all the limitations of the claimed invention, do not provide a reasonable expectation of success, and do not provide a motivation or suggestion to combine.

CLAIM 16

Claim 16 recites a process for producing alkyl esters useful in biofuels and lubricants. The process comprises providing an organic composition that comprises one or more components selected from the group consisting of acylglycerols, fats, oils, waxes, and free fatty acids. A critical fluid medium that includes one or more fluids selected from the group consisting of carbon dioxide, sulfur dioxide, methane, ethane, propane, and mixtures thereof is provided. The critical fluid medium is used to dissolve the organic composition and a C₁-C₄ short chain alcohol or water. The critical fluid medium is selected so that, when combined with the organic composition, the critical fluid medium provides decreased loss of catalyst or catalytic activity and elimination of mass transfer limitations by maintaining the organic composition and C₁-C₄ short chain alcohol or water in a single phase. The organic composition is reacted with the C₁-C₄ short chain alcohol or water in the presence of a catalyst in the single phase to produce a

final product that comprises an alkyl ester and glycerol. The glycerol leaves the single phase as it is formed.

Johnson discloses a method of reducing the crystallization temperature of a liquid fuel blend. The liquid fuel blend comprises petroleum distillates and branched chain esters that are synthesized from fatty acid triglycerides. The branched esters are produced by transesterifying the fatty acid triglycerides with anhydrous alcohols and a transesterification catalyst. The resulting branched esters are separated from glycerol by extraction techniques or distillation.

Stern teaches a process for manufacturing a composition of fatty acid esters that are useful as substitute motor fuel. The process comprises transesterifying an oil or grease in the presence of a monoalcohol and an acid catalyst. The reaction leads to the formation of a phase of high ester content and a phase of high glycerol content. The glycerol phase is removed and the acidity of the ester containing phase is decreased. The ester containing phase with decreased acidity is transesterified in the presence of an alcohol and an basic catalyst to form a phase containing mainly esters and an alcohol phase.

Bradin teaches a fuel additive composition that includes fatty acid alkyl esters and glyceryl ethers. The fuel additive composition is prepared by esterifying free fatty acids and etherifying glycerol with olefins in the presence of an acid catalyst to form the fatty acid ethyl esters and glyceryl ethers, respectively. The fatty acids are esterified by reaction with an alcohol in the presence of an acid or base catalyst. During this reaction, water is produced and forms a separate layer.

Japanese Patent No. JP 63 112 536 A discloses a fatty acid mixture obtained by hydrolyzing a fat or oil or fatty acid lower alkyl ester prepared by ester interchange with a lower alcohol. The mixture is fractionated by chromatography using a supercritical fluid as a mobile phase to concentrate and purify γ -linolenic acid.

Japanese Patent No. JP 09 157 684 A discloses purification of a highly unsaturated fatty acid ester. The unsaturated fatty acid ester is purified in an extraction column using a supercritical fluid.

The Cited References Do Not Teach Or Suggest All The Claim Limitations

Johnson, Stern, Bradin and the Japanese abstracts do not teach or suggest all the limitations of claim 16. Specifically, the cited references do not teach or suggest the following limitations: “dissolving the organic composition and either a C₁-C₄ short chain alcohol or water into the critical fluid medium,” “reacting the organic composition with the C₁-C₄ short chain alcohol or water in the presence of a catalyst in a single phase to produce a final product comprising an alkyl ester and glycerol, wherein said glycerol leaves the single phase as it is formed,” and “wherein the particular critical fluid medium is selected so that, when combined with the organic composition, the critical fluid medium provides decreased loss of catalyst or catalytic activity and elimination of mass transfer limitations by maintaining the various reactants in a single phase.”

In regard to the first of these limitations, neither Johnson, Stern, nor Bradin discloses using a critical fluid medium and, therefore, does not teach that the organic composition and a C₁-C₄ short chain alcohol or water are dissolved in the critical fluid medium. While the Japanese abstracts disclose using a supercritical fluid in a chromatographic method, they do not teach or suggest that the supercritical fluid is used to dissolve an organic composition and a C₁-C₄ short chain alcohol or water. Specifically, the Japanese abstracts do not teach that a C₁-C₄ short chain alcohol or water is dissolved in the critical fluid medium because they do not disclose using a C₁-C₄ short chain alcohol or water.

In regard to the second limitation, the cited references do not teach or suggest that the organic composition and C₁-C₄ short chain alcohol or water are reacted in a single phase to produce a final product comprising an alkyl ester and glycerol. Johnson, Stern, and Bradin do not teach or suggest a single phase reaction. In contrast, these references are either silent as to this limitation or disclose that the reactions are performed in two phases and the two phases are extracted to separate the individual products. The Japanese abstracts also do not teach this

limitation because they do not disclose a reaction. Rather, their fatty acid mixtures are merely separated and purified. Since the Japanese abstracts do not disclose a reaction, they also do not disclose reacting an organic composition and C_1 - C_4 short chain alcohol or water in a single phase to produce an alkyl ester and glycerol. More specifically, the Japanese abstracts do not disclose reacting a C_1 - C_4 short chain alcohol or water and forming an alkyl ester and glycerol. In addition, since the Japanese abstracts do not disclose a reaction, they necessarily do not teach or suggest that the reaction is in a single phase.

The cited references also do not teach or suggest that the glycerol leaves the single phase as it is formed. Johnson, Stern, and Bradin are either silent as to how the resulting products are separated or disclose that the products of their respective reactions are extracted. Since the Japanese abstracts do not even teach a reaction in a single phase that forms glycerol, the Japanese abstracts do not teach that the glycerol leaves the single phase as it is formed.

The cited references also do not teach or suggest the third limitation of how the critical fluid medium is selected. As previously mentioned Johnson, Stern and Bradin do not disclose a critical fluid medium and, therefore, do not teach or suggest that the critical fluid medium is selected to provide decreased loss of catalyst or catalytic activity and elimination of mass transfer limitations by maintaining the various reactants in a single phase. While the Japanese abstracts disclose a supercritical fluid, they do not teach or suggest that the supercritical fluid is selected to provide decreased loss of catalyst or catalytic activity and elimination of mass transfer limitations by maintaining the various reactants in a single phase. Furthermore, since the Japanese abstracts do not disclose a reaction, they do not disclose that the supercritical fluid is selected to maintain the reactants in a single phase when combined with the organic composition.

The Cited References Do Not Provide An Expectation Of Success

The cited references do not provide a reasonable expectation of success. Nothing in Johnson, Stern, or Bradin suggests that a critical fluid medium could be used in their respective methods. Therefore, there is no reasonable expectation that the supercritical fluid disclosed as a

mobile phase in the Japanese abstracts could be successfully combined with the teachings of Johnson, Stern, or Bradin to produce the invention of claim 16. Furthermore, nothing in the Japanese abstracts suggests that the supercritical fluid could be used as a critical fluid medium to dissolve an organic composition and a short chain alcohol or water, where the organic composition and the short chain alcohol or water are reacted to produce an alkyl ester and glycerol. Moreover, any resulting combination of these references would result in a method that still lacks a single phase reaction, lacks a teaching that glycerol leaves the single phase as it is formed, and lacks a teaching that a critical fluid medium is selected to provide decreased loss of catalyst or catalytic activity and elimination of mass transfer limitations by maintaining the reactants in a single phase.

The Cited References Do Not Provide A Motivation To Combine

There is no motivation to combine Johnson with Stern or Bradin in view of the Japanese abstracts to produce the claimed invention. Specifically, the cited references do not provide a motivation to produce a process for producing alkyl esters that comprises reacting the organic composition with the C₁-C₄ short chain alcohol or water in a single phase. Nothing in Johnson, Stern, and Bradin discloses that the organic composition and the C₁-C₄ short chain alcohol or water are reacted in a single phase. In addition, these references do not even suggest the desirability of, or provide an objective reason for, combining the teachings of the references.

The Japanese abstracts also do not provide a motivation to combine because they do not disclose reacting the organic composition and a C₁-C₄ short chain alcohol or water, let alone that these chemical components are reacted in a single phase. Furthermore, the Japanese abstracts do not suggest the desirability of, or provide an objective reason for, combining its teaching that a critical fluid can be used as a mobile phase in a chromatographic technique with the reactions disclosed in Johnson, Stern, and Bradin.

Since the cited references do not teach or suggest all the limitations of the claimed invention, do not provide a reasonable expectation of success, and do not provide a motivation or

suggestion to combine, a *prima facie* case of obviousness has not been established. Therefore, applicants respectfully request that the rejection of claim 16 be withdrawn.

Claims 17-27 are allowable, among other reasons, as depending from claim 16.

Claim 21 is further allowable because the cited references do not disclose that the solid phase catalyst is a microporous crystalline solid.

Claim 22 is further allowable because the cited references do not disclose that the solid phase catalyst is an exchange resin with either acidic or basic properties.

Claim 23 is further allowable because the cited references do not disclose that the solid phase catalyst is an inorganic oxide selected from the group consisting of alumina, silica, silica-alumina, boria, oxides of phosphorus, titanium dioxide, zirconium dioxide, chromia, zinc oxide, magnesia, ion exchange resins, silicate catalysts, and calcium oxide either unmodified or modified with chlorine, fluorine, sulfur or an acid or base.

Claim 24 is further allowable because the cited references do not disclose separating the glycerol from the final product and separating the alkyl ester from the critical fluid. Johnson, Stern, and Bradin do not disclose a critical fluid and, therefore, do not disclose that the alkyl ester is separated from the critical fluid. The Japanese abstracts do not disclose forming glycerol and, therefore, do not disclose that it is separated from the final product. The Japanese abstracts also do not disclose separating the alkyl ester from the critical fluid.

Claim 25 is further allowable because the cited references do not disclose recycling the critical fluid medium for use in a later reaction.

CLAIM 28

Claim 28 recites a process for producing alkyl esters useful in biofuels and lubricants. The process comprises providing an organic composition that comprises one or more components selected from the group consisting of acylglycerols, fats, oils, waxes, and free fatty acids. A critical fluid medium that includes one or more fluids selected from the group

consisting of carbon dioxide, sulfur dioxide, methane, ethane, propane, and mixtures thereof is provided. Optionally, the critical fluid medium includes one or more critical fluid co-solvents selected from the group consisting of methanol, ethanol, butanol, and water. The organic composition and a C₁-C₄ short chain alcohol or water are dissolved in the critical fluid medium. The organic composition reacts with the short chain alcohol or water in the presence of a catalyst in a single phase to produce a final product comprising an alkyl ester and glycerol. The glycerol leaves the single phase as it is formed. The glycerol is separated from the final product by modifying the temperature and pressure of the final product while the alkyl ester product is separated from the critical fluid by modifying the temperature and pressure of the critical fluid medium.

The teachings of Johnson, Stern, Bradin, and the Japanese abstracts are as summarized previously.

The Cited References Do Not Teach Or Suggest All The Claim Limitations

Johnson, Stern, Bradin and the Japanese abstracts do not teach or suggest all the limitations of claim 28. Specifically, the cited references do not teach or suggest the following limitations: “dissolving the organic composition and either a C₁-C₄ short chain alcohol or water into the critical fluid medium,” “reacting the organic composition with the C₁-C₄ short chain alcohol or water in the presence of a catalyst in a single phase to produce a final product comprising an alkyl ester and glycerol, wherein said glycerol leaves the single phase as it is formed,” “separating said glycerol from said final product by modifying the temperature and pressure of the final product,” and “separating said alkyl ester product from said critical fluid by modifying the temperature and pressure of the critical fluid medium.”

The first two limitations are the same limitations discussed above in regard to claim 16 and, therefore, are not taught or suggested for the reasons discussed above for claim 16.

The cited references also do not teach or suggest the limitations of “separating said

glycerol from said final product by modifying the temperature and pressure of the final product” and “separating said alkyl ester product from said critical fluid by modifying the temperature and pressure of the critical fluid medium.” Johnson, Stern, and Bradin do not teach or suggest that their respective products are separated from the final product by modifying the temperature and pressure of the final product. Rather, these references are silent as to this aspect or disclose that the desired products are separated from the undesired products by extraction techniques.

Johnson, Stern, and Bradin also do not teach or suggest that the alkyl ester product is separated from the critical fluid medium by modifying the temperature and pressure of the critical fluid medium because these references do not teach or suggest using a critical fluid medium.

The Japanese abstracts also do not teach or suggest these limitations because while a supercritical fluid is disclosed, this supercritical fluid is used as a mobile phase in a chromatographic technique. The Japanese abstracts do not disclose that glycerol is separated from the final product by modifying the temperature and pressure of the final product because the Japanese abstracts do not disclose a chemical reaction, let alone a reaction that forms glycerol. Since no glycerol is formed, glycerol can not be separated from the final product. In addition, the Japanese abstracts do not disclose that the alkyl ester product is separated from the critical fluid by modifying the temperature and pressure of the critical fluid medium.

The Cited References Do Not Provide A Reasonable Expectation Of Success Or A Motivation To Combine

The cited references do not provide a reasonable expectation of success or a motivation to combine for the same reasons discussed above with claim 16.

Since the cited references do not teach or suggest all the limitations of the claimed invention, do not provide a reasonable expectation of success, and do not provide a motivation or suggestion to combine, a *prima facie* case of obviousness has not been established. Therefore, applicants respectfully request that the rejection of claim 28 be withdrawn.

CLAIM 29

Claim 29 recites a process for producing alkyl esters useful in biofuels and lubricants.

The process comprises providing an organic composition comprising one or more components selected from the group consisting of acylglycerols, fats, oils, waxes, and free fatty acids. A critical fluid medium including one or more fluids selected from the group consisting of carbon dioxide, sulfur dioxide, methane, ethane, propane, and mixtures thereof is provided. The organic composition and a C₁-C₄ short chain alcohol or water are dissolved into the critical fluid medium.

The organic composition is reacted with the short chain alcohol or water in the presence of a catalyst at a temperature from about 20°C to about 200°C and a pressure from about 150 psig to about 4000 psig. The reaction occurs in a single phase to produce a final product comprising an alkyl ester and glycerol and the glycerol leaves the single phase as the glycerol is formed. The critical fluid is selected to have a critical temperature within about 20% of the reaction temperature and a critical pressure as modified by a co-solvent within a range of about 0.5 to about 15 times the reaction pressure.

The teachings of Johnson, Stern, Bradin, and the Japanese abstracts are as summarized previously.

The Cited References Do Not Teach Or Suggest All The Claim Limitations

Johnson, Stern, Bradin and the Japanese abstracts do not teach or suggest all the limitations of claim 29. Specifically, the cited references do not teach or suggest the following limitations: "dissolving the organic composition and either a C₁-C₄ short chain alcohol or water into the critical fluid medium," "reacting the organic composition with the short chain alcohol or water in the presence of a catalyst at a temperature from about 20°C to about 200°C and a pressure from about 150 psig to about 4000 psig, wherein the reaction occurs in a single phase to produce a final product comprising an alkyl ester and glycerol and wherein said glycerol leaves the single phase as the glycerol is formed," and "wherein the critical fluid is one selected to have

a critical temperature within about 20% of the reaction temperature and a critical pressure as modified by a co-solvent within a range of about 0.5 to about 15 times the reaction pressure.”

The first and second of these limitations are not taught or suggested by the cited references, as previously discussed in regard to claims 16 and 28. The cited references also do not teach or suggest the reaction conditions of a temperature from about 20°C to about 200°C and a pressure from about 150 psig to about 4000 psig.

The cited references do not teach or suggest the third limitation of “wherein the critical fluid is one selected to have a critical temperature within about 20% of the reaction temperature and a critical pressure as modified by a co-solvent within a range of about 0.5 to about 15 times the reaction pressure.” Johnson, Stern, and Bradin do not teach or suggest this limitation because they do not disclose using a critical fluid medium. The Japanese abstracts also do not teach or suggest this limitation because they do not disclose criteria to select their supercritical fluid. In addition, the Japanese abstracts do not teach or suggest that a critical temperature of the critical fluid is within about 20% of the reaction temperature and that a critical pressure as modified by a co-solvent is within a range of about 0.5 to about 15 times the reaction pressure.

The Cited References Do Not Provide A Reasonable Expectation Of Success Or A Motivation To Combine

The cited references do not provide a reasonable expectation of success or a motivation to combine for the same reasons discussed above with claim 16.

Since the cited references do not teach or suggest all the limitations of the claimed invention, do not provide a reasonable expectation of success, and do not provide a motivation or suggestion to combine, a *prima facie* case of obviousness has not been established. Therefore, applicants respectfully request that the rejection of claim 29 be withdrawn.

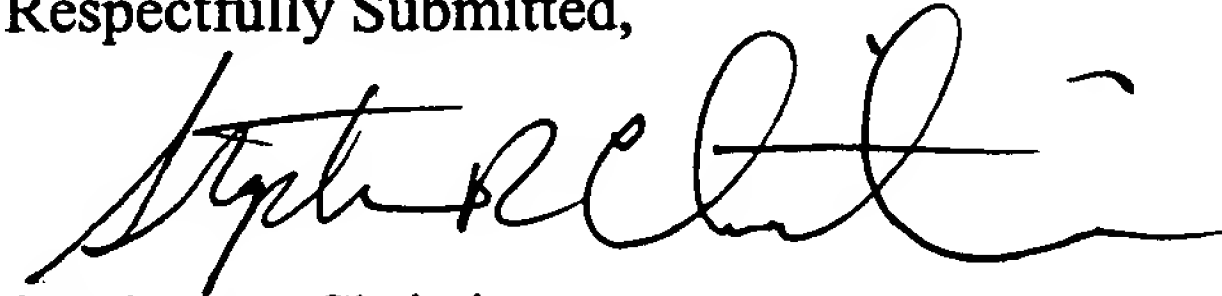
ENTRY OF AMENDMENTS

The amendment to claim 29 above should be entered by the Examiner because the amendment is supported by the as-filed specification and drawings and does not add any new matter to the application.

CONCLUSION

Claims 16-30 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the examiner determine that additional issues remain which might be resolved by a telephone conference, she is respectfully invited to contact applicants' undersigned attorney.

Respectfully Submitted,



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Enclosure: Version With Markings to Show Changes Made

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

29. (Amended) A process for producing alkyl esters useful in biofuels and lubricants, said process comprising:

providing an organic composition comprising one or more components selected from the group consisting of acylglycerols, fats, oils, waxes, and free fatty acids;

providing a critical fluid medium including one or more fluids selected from the group consisting of carbon dioxide, sulfur dioxide, methane, ethane, propane, and mixtures thereof;

dissolving the organic composition and either a C_1 - C_4 short chain alcohol or water into the critical fluid medium; and

reacting the organic composition with the short chain alcohol or water in the presence of a catalyst at a temperature from about 20°C to about 200°C and a pressure from about 150 psig to about 4000 psig, wherein the reaction occurs in a single phase to produce a final product comprising an alkyl ester and glycerol and wherein said glycerol leaves the single phase as the glycerol is formed;

wherein the critical fluid is one selected to have a critical temperature within about 20% of the reaction temperature and a critical pressure as modified by [any] a co-solvent within a range of about 0.5 to about 15 times the reaction pressure.

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